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(54) Abstract Title
**A safety device for vehicle window**

(57) A safety device for use in a motor vehicle includes a restraining element which may be in the form of a net (4 in figure 3) initially stored within a housing (3) extending across the entire upper edge of a windscreen (2). Pull cords (5,6) attached to the edges of the net extend downwardly past guide means (7,8) located adjacent the lower edges of the windscreen to a centrally located drive mechanism (9). Further pull cords (10,11) extend from positions further towards the central part of the lower edge of the net, and initially extend around the outer periphery of the windscreen being retained by yieldable means. The pull cords (10,11) pass guide means (14,15) located adjacent the lower edge of the windscreen and thus to the drive mechanism. When a vehicle deceleration greater than a pre-determined rate is sensed the drive mechanism applies a tension to the pull cords (5,6,10,11) such that the net is drawn to a position in which it extends across the windscreen. Pull cords (10,11) may be wound in at a faster rate than pull cords (5,6) as after the drive mechanism is started they become slack due to being released from the yieldable material (see figure 3).

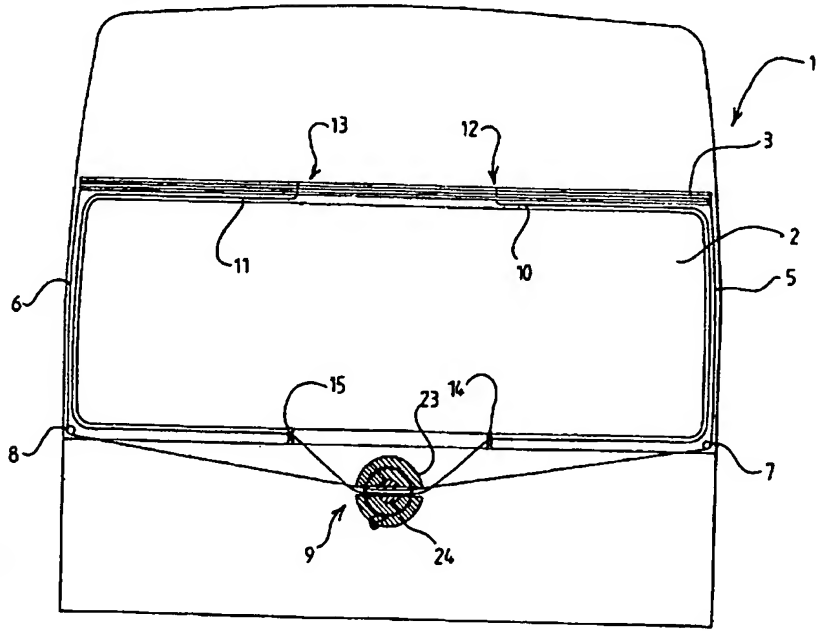


FIG 1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

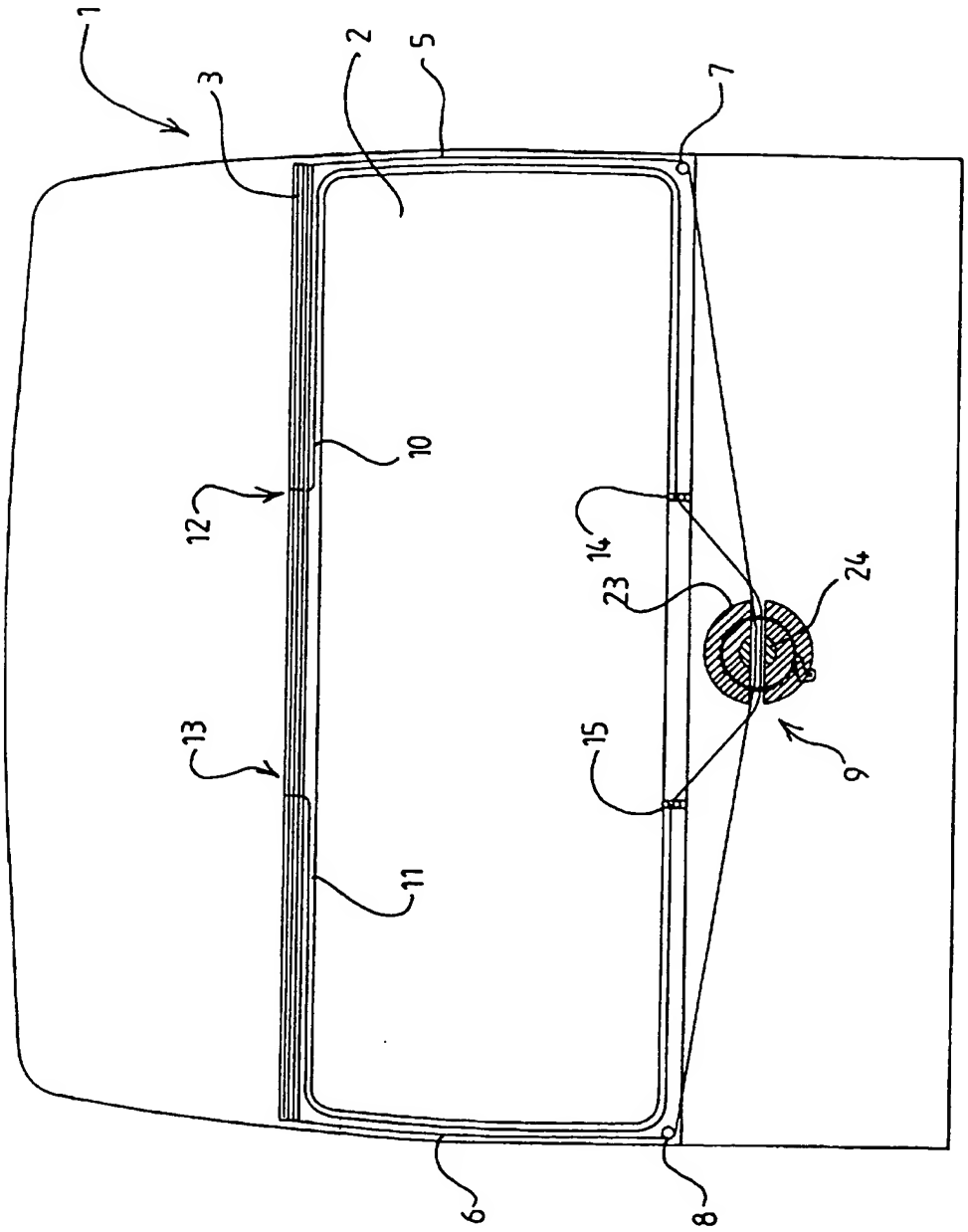



FIG 1

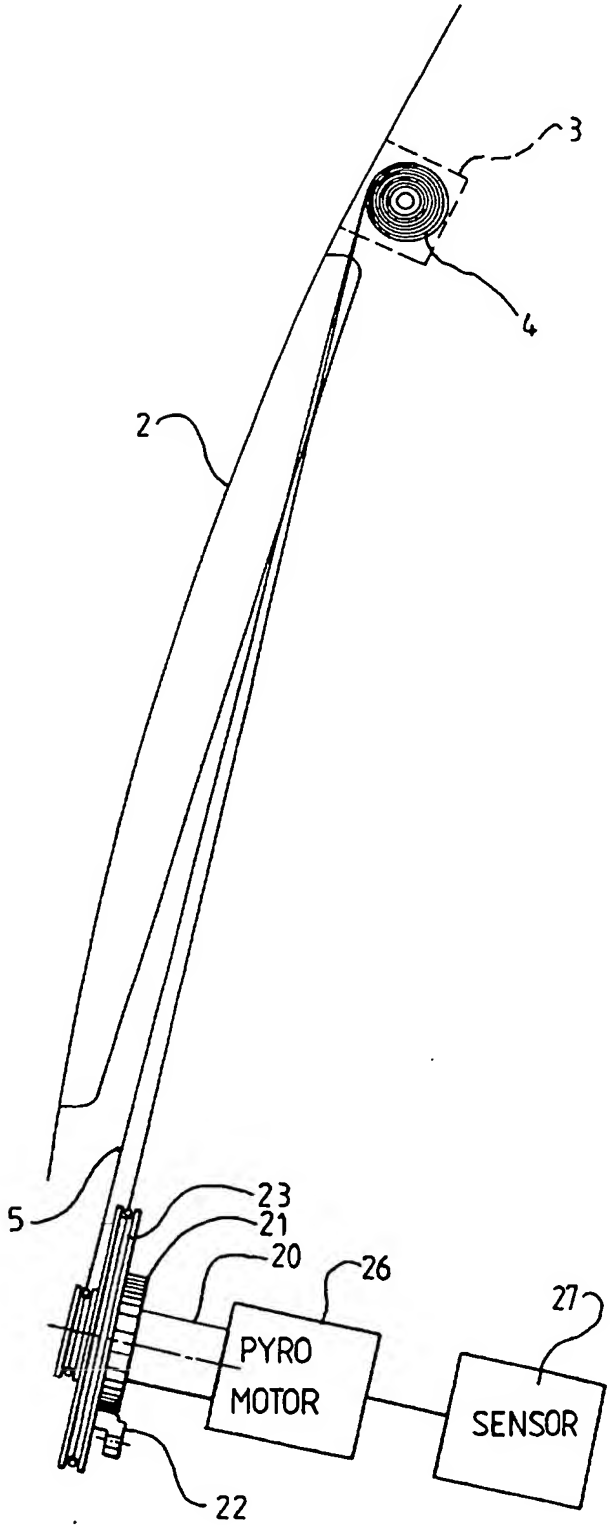
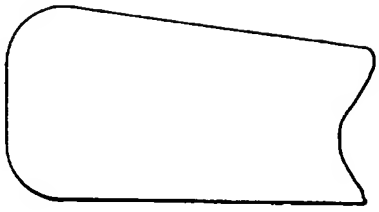



FIG 2



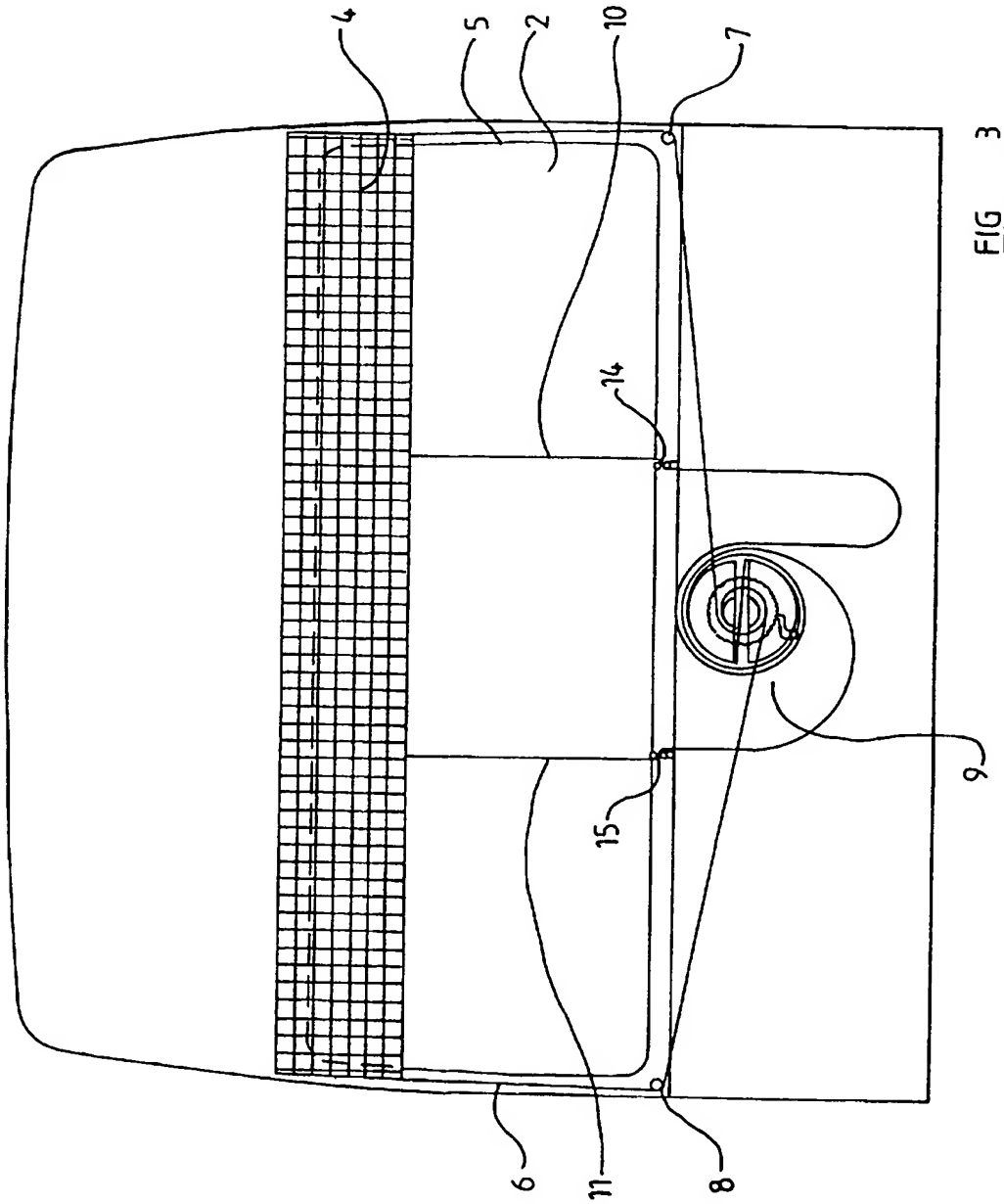



FIG 3

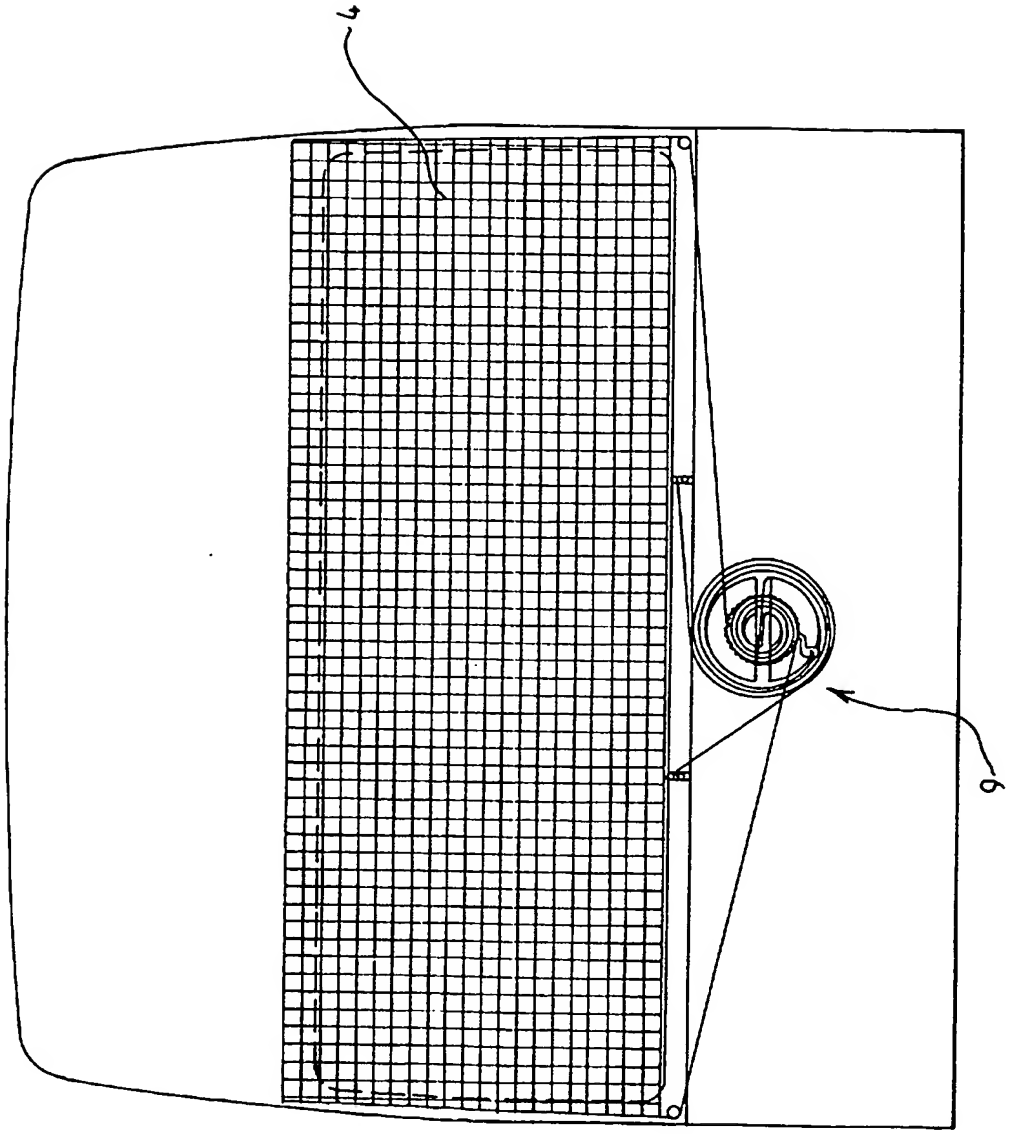



FIG 4

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PATENTS ACT 1977

P13136GB-NF/jsd

DESCRIPTION OF INVENTION

# "IMPROVEMENTS IN OR RELATING TO A SAFETY DEVICE"

**THE PRESENT INVENTION** relates to a safety device, and more particularly relates to a safety device mounted in a vehicle having a very large front windscreen or windshield, such as a lorry, truck, bus or coach.

It has been found that the drivers of vehicles with large windscreens, such as lorries, trucks, buses or coaches, have a tendency not to wear to seat belts. It is difficult to provide a satisfactory air-bag restraint for a driver of such a vehicle, and the present invention seeks to provide a safety device for use in such a vehicle.

According to this invention there is provided a safety device in a motor vehicle, the safety device comprising a restraining element, the restraining element initially being retained at a position above a front windscreen or windshield of the vehicle, the restraining element being associated with a plurality of pull cords, drive means being provided to wind in the pull cords in response to a signal from a sensor responsive to a predetermined deceleration or impact of the vehicle, the pull cords comprising two pull cords, each of which is connected to a respective point on the restraining element, substantially adjacent a side edge thereof, and which extend adjacent respective

side edges of the windshield, past guide means located adjacent the side edges of the windshield towards the drive means, and further cords initially extending from respective points spaced inwardly of the side edges of the windshield, around the periphery of the windshield to guide means located substantially beneath said respective points, and thus to the drive means.

In one embodiment the said further cords are connected to the restraining device.

In an alternative embodiment the said further cords are connected to the vehicle at points adjacent the restraining element.

Preferably the drive means are adapted to wind in the first pull cords at a predetermined rate, and are adapted to wind in the said further pull cords at a second, higher, predetermined rate.

Conveniently the drive means are adapted initially to tension the further cords between said respective points and said guide means located beneath said respective points, and then to apply tension to said two pull cords to deploy the restraining element.

Advantageously the drive means comprises a shaft, means to rotate the shaft in response to a signal from said sensor, the shaft driving a relatively large diameter pulley, and a relatively small diameter pulley, the relatively small diameter pulley being adapted to wind in the said two pull cords, and the relatively large diameter pulley being adapted to wind in the further pull cords.

Conveniently the drive mechanism incorporates one or more pulley wheels of the same diameter to drive the said two pull cords and the further pull

cords, the said two pull cords initially incorporating a degree of slack such that when the drive mechanism is actuated, the further pull cords become substantially taut between the said respective points and the said guide means, whilst the slack in the said two pull cords is wound in.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a diagrammatic view of the front part of the vehicle provided with a safety device in accordance with the invention, before the safety device is deployed,

FIGURE 2 is a vertical sectional view taken through the figure of Figure 1,

FIGURE 3 is a view corresponding to Figure 1 illustrating the safety device during deployment, and

FIGURE 4 is a view corresponding to Figure 1 illustrating the safety device after the safety device has been deployed.

Referring initially to Figures 1 and 2 of the accompanying drawings, the front part 1 of a vehicle is illustrated. The vehicle is in the form of a lorry or truck, bus or coach, and has a large windscreen (or windshield) 2 which extends across the entire width of the vehicle.

Mounted above the windscreen is a housing 3 which extends across the entire width of the windscreen 2. The housing is located adjacent the upper side edge of the windscreen 2. Contained within the housing is a restraining element, in this embodiment in the form of a net 4 (see Figure 3), although a sheet or some other equivalent restraining device may be used. The net 4, in its initial state, is tightly packed within the housing 3. The net may be rolled on to a spindle, or folded.

Two pull cords 5, 6 are connected respectively to opposed side edges of the net within the housing. The pull cords 5,6 extend downwardly, on either side of the windscreen 2 to guide means 7, 8 which are located beneath the lower edge of the windscreen 2, and which have a spacing between them greater than the width of the windscreen 2. The pull cords 5, 6 then extend, from the guide means, substantially inwardly and downwardly to a centrally located drive mechanism 9 which is positioned, in the described embodiment, beneath the windscreen 2 and substantially centrally of the vehicle.

In the illustrated embodiment, two further pull cords 10, 11 are provided. These pull cords are connected to the net 4 at points 12, 13, which are spaced inwardly from the side edges of the net 4, and which are thus also spaced inwardly from the side edges of the windscreen 2, the points 12 and 13 being located above the windscreen 2, but being symmetrically located relative to the central vertical axis of the windscreen or windshield 2.

The pull cords 10, 11, extend from the points 12, 13, around the exterior of the windscreen or windshield 2, until the pull cords reach guide means 14, 15 which are located adjacent the lower edge of the windshield respectively immediately beneath the points 12, 13.

The pull cords 10, 11 are retained, between the points 12 and 13 and the guide means 14 and 15 by some yieldable means, such as a restraining strip formed of a plastics material, so that the pull cords are retained in position inconspicuously, surrounding the windscreen. In the event that tension is applied to the pull cords 10, 11, the pull cords will move from the initial position surrounding the windscreen to a position in which they extend between the points 12 and 13, and the guide means 14 and 15.

The pull cords 10, 11 extend from the guide means 14, 15 to the drive mechanism 9.

The drive mechanism 9 has, as can be seen most clearly from Figure 2, a rotatable shaft 20 which carries a toothed wheel 21 adapted to co-operate with a ratchet 22. Thus the shaft may be driven to rotate in one direction, but rotation in the opposite direction is prevented. The shaft 20 carries a relatively large diameter pulley wheel 23 adapted to apply tension to the pull cords 10 and 11, and also carries a relatively small diameter pulley wheel 24 adapted to apply tension to the pull cords 5 and 6.

As can be seen from Figure 1, the pulley wheels 23 and 24 are provided with a diametrically extending channel which receives a cord portion which inter-connects the pull cords 5 and 6, and which also receives a cord portion which interconnects the pull cords 10 and 11.

The shaft 20 is associated with a pyrotechnic motor 26 adapted to be actuated to rotate the shaft 20 in said one direction in response to a signal from a sensor 27 which senses a predetermined deceleration or impact of the vehicle.

In the event that the sensor senses a predetermined deceleration or impact, the pyrotechnic motor 26 is activated causing the shaft 20 to rotate. As the shaft 20 rotates, the cord portion interconnecting the pull cords 5 and 6 becomes engages with the relatively small diameter pulley wheel 24, and tension is applied to the pull cords 5 and 6. The pull cords 5 and 6 commence to pull the net 4 out of the housing 3.

Simultaneously the portion of cord interconnecting the pull cords 10 and 11 is engaged by the larger diameter pulley wheel 23, and the pulley wheel applies tension to the pull cords 10 and 11. Initially the pull cords 10 and 11 become separated from the yieldable means retaining them in position around the periphery of the windscreen or windscreen 2. This is the situation shown in Figure 3. The cords 10 and 11, because of their length, are slack. Subsequently pull cords 10 and 11 become tensioned between the points 12 and 13 by which they are connected to the net 4, and the guide means 14, 15.

Because the pull cords 10 and 11 are engaged with the larger diameter pulley wheel 23, as compared with the diameter of the pulley wheel 24 engaging the pull cords 5 and 6, the pull cords 10 and 11 are wound in by the drive mechanism 9 at a faster rate than the pull cords 5 and 6.

The diameter of the pulley wheels is chosen so that when the net 4 reaches a fully deployed position, as shown in Figure 4, the pull cords 5 and 6 are fully tensioned, and also the pull cords 10 and 11 are fully tensioned.

The net is thus fully deployed across the windscreen or windshield 2 in front of the driver of the vehicle, and if the driver of the vehicle is thrown forwardly, the driver will be retained by the net.

It is to be understood that in the embodiment described above, a substantially equal tension may be applied by the drive mechanism 9 to each of the pull cords 5, 6, 10 and 11 when the net is fully deployed. When the net is in this position, the ratchet 22 engages the toothed wheel 21, serving to retain the net in the fully deployed position.

It is to be appreciated that whilst the described embodiment relates to an arrangement in which four pull cords are provided, it may be appropriate to use six, or any other convenient number of pull cords, using pulley wheels of appropriate relative diameters. In a simple embodiment there may be a single central pull cord and two side pull cords corresponding to the cords 5 and 6 described above.

Whilst, in the described embodiment, all of the pull cords are used to pull the net down, it is to be appreciated that in a modified embodiment of the invention, only a certain number of pull cords, for example the two pull cords located on either side of the windshield, may pull the net down, and the remaining cord or cords may have their ends not fixed to the net, but instead have their ends fixed to the housing 3 which contains the net. These remaining cords would then become tensioned, acting as guide cords along which the net may move as it proceeds from the initial stored position to the final deployed position, these remaining cords thus providing a substantially taut reinforcement for the net, helping ensure that the net is not distorted when impacted by the driver or occupant of the vehicle.

Whilst in the described embodiment a drive arrangement is provided which involves the use of pulley wheels of different diameters, it is to be appreciated that further alternative mechanisms may be used adapted to apply different "winding" rates to the pull cords so that the desired effect is achieved.

In one possible alternative embodiment, the pull cords 10 and 11 may be wound in by the driving mechanism until they extend tightly between the points 12 and 13, and the guide means 14 and 15 before tension is applied to the pull cords 5 and 6. This may be achieved by a drive means including a first pulley wheel adapted to wind in the pull cords 10 and 11, with that pulley wheel being adapted to rotate a predetermined amount (e.g. a predetermined number of turns) before a second a pulley wheel, which winds in the pull cords 5 and 6, commences rotation. Alternatively, the pull cords 10 and 11 may initially be relatively taut, whereas a substantial degree of "slack" may be provided in the pull cords 5 and 6. Thus, on actuation of the drive means, initially the slack is wound in present in the pull cords 5 and 6, while the pull cords 10 and 11 are wound in until they extend substantially tautly between the points 12 and 13, and the guide means 14 and 15. Subsequent movement of the drive means will apply equal tension to all four of the pull cords so that the net is pulled evenly from the stored position to the deployed condition.

Whilst the invention has been described with reference to a restraining device in the form of a net, which is preferred because a driver can see through the net when the device is in the deployed position, alternative forms of restraining device could be utilised. Thus the restraining device could comprise a sheet-like material, preferably with one or more transparent regions formed therein to assist forward visibility in the event that the restraining device is deployed. In a further alternative embodiment the restraining device itself may incorporate one or more inflatable elements adapted to be located, for example, adjacent the side pillars of the windscreen or windshield 2.

CLAIMS:

1. A safety device in a motor vehicle, the safety device comprising a restraining element, the restraining element initially being retained at a position above a front windscreen or windshield of the vehicle, the restraining element being associated with a plurality of pull cords, drive means being provided to wind in the pull cords in response to a signal from a sensor responsive to a predetermined deceleration or impact of the vehicle, the pull cords comprising two pull cords, each of which is connected to a respective point on the restraining element, substantially adjacent a side edge thereof, and which extend adjacent respective side edges of the windshield, past guide means located adjacent the side edges of the windshield towards the drive means, and further cords initially extending from respective points spaced inwardly of the side edges of the windshield, around the periphery of the windshield to guide means located substantially beneath said respective points, and thus to the drive means.

2. An arrangement according to Claim 1 in which the said further cords are connected to the restraining device.

3. A safety arrangement according to Claim 1 wherein the said further cords are connected to the vehicle at points adjacent the restraining element.

4. An arrangement according to any one of the preceding Claims wherein the drive means are adapted to wind in the first pull cords at a predetermined rate, and are adapted to wind in the said further pull cords at a second, higher, predetermined rate.

5. An arrangement according to any one of Claims 1 to 3 wherein the drive means are adapted initially to tension the further cords between said respective points and said guide means located beneath said respective points, and then to apply tension to said two pull cords to deploy the restraining element.

6. A safety device according to Claim 4 or 5 wherein the drive means comprises a shaft, means to rotate the shaft in response to a signal from said sensor, the shaft driving a relatively large diameter pulley, and a relatively small diameter pulley, the relatively small diameter pulley being adapted to wind in the said two pull cords, and the relatively large diameter pulley being adapted to wind in the further pull cords.

7. A safely device according to any one of Claims 1 to 3 and 5 wherein the drive mechanism incorporates one or more pulley wheels of the same diameter to drive the said two pull cords and the further pull cords, the said two pull cords initially incorporating a degree of slack such that when the drive mechanism is actuated, the further pull cords become substantially taut between the said respective points and the said guide means, whilst the slack in the said two pull cords is wound in.

8. A safety device substantially as herein described with reference to and as shown in the accompanying drawings.

9. Any novel feature or combination of features disclosed herein.

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| **Application No:** | GB 9915824.8 | **Examiner:** | P Gardiner |
| **Claims searched:** | 1 - 8 | **Date of search:** | 12 November 1999 |

## Patents Act 1977
## Search Report under Section 17

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): B7B: BSBA, BSBCX, BSDB

Int Cl (Ed.6): B60R: 21/00, 21/02, 21/06, 21/08, 21/16,

Other: Online: WPI, EPODOC, JAPIO

**Documents considered to be relevant:**

| Category | Identity of document and relevant passage | Relevant to claims |
|---|---|---|
| A | GB 1268103 NISSAN (see Figure 1) | |

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|---|---|---|---|
| X | Document indicating lack of novelty or inventive step | A | Document indicating technological background and/or state of the art. |
| Y | Document indicating lack of inventive step if combined with one or more other documents of same category. | P | Document published on or after the declared priority date but before the filing date of this invention. |
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